METHOD AND APPARATUS FOR MOUNTING HOPPER ON PAINT BALL GUN RISER

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01/02/04

TOD R. NISSLE, Reg. No. 29,241 DATE

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This invention pertains to paint ball apparatus.

More particularly, the invention pertains to a method and apparatus for mounting a paint ball hopper on the riser of a paint ball gun.

In a further respect, the invention pertains to a method and apparatus that enables a paint ball hopper to be adapted for mounting on different sized risers on a paint ball gun.

Each paint ball gun typically includes a hollow riser. The riser includes an inner cylindrically shaped surface. This inner surface slidably receives the outer cylindrically shaped surface of the neck of a paint ball hopper . The neck is hollow. When the neck is slidably inserted in the riser, paint balls can be fed from the hopper downwardly through the riser into the paint ball gun in conventional fashion. Paint balls can be fed from the hopper into the paint gun under gravity or with mechanical assistance from mechanisms that are incorporated in the hopper.

A particular problem associated with paint ball guns is that the hopper neck does not properly fit the riser. The hopper neck may be too loose or too tight, depending on the diameter of the inner cylindrical wall of the riser. If the fit of the hopper neck in the riser is too tight, the riser can be damaged when the neck is forced into the riser. If the fit of the hopper neck in the riser is too loose, the hopper may fall free from the riser.

Accordingly, it would be highly desirable to provide an improved method and apparatus for adapting the hopper neck to fit securely in risers of varying size.

Therefore, it is a principal object of the invention to provide an improved hopper for use in conjunction with a paint ball gun.

Another object of the invention is to provide an improved method and apparatus for adapting the neck of a paint ball hopper to fit slidably in the riser of a paint ball gun.

A further object of the invention is to provide a paint ball hopper neck that elastically conforms to the shape and dimension of the inner surface of a paint ball gun riser.

Still another object of the invention is to provide a paint ball hopper neck that includes an arcuate elastic surface that rolls over the inner surface of a paint ball

gun riser.

These and other, further and more specific objects and advantages of the invention will be apparent to those skilled in the art from the following detailed description thereof, taken in conjunction with the drawings, in which:

Fig. 1 is a front view of a paint ball hopper and paint ball gun illustrating insertion of the hopper neck in the riser of the paint ball gun;

Fig. 2 is a perspective view illustrating the neck of a paint ball hopper and the riser of a paint ball gun and depicting additional construction details thereof;

Fig. 3 is a side section view illustrating elastomeric O-rings used in the practice of the invention;

Fig. 4 is a side section view illustrating differing sized O-rings used in the practice of the invention;

Fig. 5 is a side section view of a portion of the neck of a paint ball hopper illustrating an O-ring seated in a groove thereof and illustrating the mode of operation thereof;

Fig. 6 is a side section view of the neck of Fig. 4 further illustrating the

mode of operation of the O-ring and groove;

Fig. 7 is a side section view illustrating an O-ring and groove;

Fig. 8 is a side section view of the O-ring and groove of Fig. 7 after the neck of a paint ball hopper is inserted in the riser of a paint ball gun to compress the O-ring; and

Fig. 9 is a side section view of the O-ring and groove of Fig. 7 after the neck of a paint ball hopper is inserted in the riser of a paint ball gun to compress the O-ring.

Briefly, in accordance with the invention, I provide an improved paint ball hopper. The hopper is used in combination with a paint ball gun. The paint ball gun includes a housing; a hollow riser having an inner surface having a size selected from the class consisting of a first size and a second size larger than the first size; and, apparatus for receiving and shooting paint balls entering the riser. The improved paint ball hopper includes a hollow storage container for paint balls; a hollow neck having an outer surface; and, at least one elastomeric member mounted on the outer surface. The neck and elastomeric member are shaped and dimensioned to be inserted in the hollow riser and to engage frictionally slidably the inner surface when the inner surface has a size consisting of either the first size or the second size.

Turning now to the drawings, which depict the presently preferred embodiments of the invention for the purpose of illustrating the practice thereof and not by way of limitation of the scope of the invention and in which like reference characters refer to corresponding elements throughout the several views, Fig. 1 illustrates a paint ball hopper 10 and paint ball gun 100. Gun 100 includes hollow cylindrically shaped riser 11. Riser 11 has upper circular lip 19. Hopper 10 includes a hollow cylindrical neck 12 shaped and dimensioned to fit into hollow riser 11. Neck 12 includes lower circular edge or lip 18. The shape and dimension of riser 11 and neck 12 can vary as desired. Elastic O-rings 16 and 17 are mounted on the outside of neck 12. Hopper 10 also includes a hollow housing or body 15 for storing spherically shaped paint balls, includes a mouth 14 for inserting paint balls into body 15, and includes a lid 13. Lid 13 pivots in the directions indicated by arrows A between a first position that closes mouth 14 and a second position that opens mouth 14.

As is well known, paint balls in hopper 10 fall under gravity and/or with mechanical assistance from hopper 10 through riser 11 into gun 100. As is also well known, gun 100 includes apparatus hat receives paint balls moving downwardly through riser 11 and that, when trigger 36 is pulled, shoots at least one paint ball outwardly through barrel 35 into the air.

Neck 12 includes a plurality of outwardly projecting ribs 23, 25. The ribs are important because they engage the inner surface of riser 11 and tend to restrict rotation of neck 12 in a direction that circumscribes arrow B such that ribs 23, 25 move

over surface 26 on the inside of riser 11. Circumferential grooves 21, 20 are formed through ribs 23, 25 to seat O-rings 16 and 17 in the manner shown in Fig. 1. O-rings 16 and 17 are displaced in the direction of arrows C and D downwardly over neck 12 and are resiliently stretched over the outer surface of neck 12 to elastically constrict and seat in grooves 21 and 20, respectively.

While the shape and dimension of a elastomeric O-ring can vary as desired, a portion of an O-ring seated in a groove 21 typically extends outwardly from the groove 21 at least several thousandths of an inch, and typically is compressed by inner surface 26 when neck 12 is slidably inserted in riser 11 in the direction indicated by arrow B in Fig. 2. A portion of O-ring 17 can, if desired, extend outwardly away from groove 21 more or less than several thousandths of an inch, and the depth of a groove 21 can be varied as desired.

The distance that a portion of O-ring 17 (or 16) extends outwardly from groove 21, and the depth of a groove 21 are varied such that O-ring 17 is compressed each time neck 12 is inserted in a riser having an inner surface 26 with a diameter or other dimension the causes the O-ring 17 to be compressed, and preferably such that O-ring 17 will sealingly compressibly contact the inner surface 26 of at least two risers each having a different diameter surface 26. The shape and dimension of surface 26 can be varied as desired. Surface 26 is preferably, but need not be, cylindrically shaped.

O-rings of differing size can be provided to be mounted on neck 12 to facilitate the interfitting of neck 12 in risers 11 each having an inner surfaces 26 of a different size and dimension. One method of providing O-rings of differing size is to have O-rings each having a different outer diameter (OD). In Fig. 4, O-ring 30 has an OD that is greater than the OD of O-ring 17. The difference in OD between O-ring 17 and O-ring 30 is exaggerated in Fig. 4. Normally the increase or decrease in the OD from one O-ring size to another is not be as marked.

Another method of providing O-rings of differing size is to have O-rings that each have the same OD, but that each have a different circular cross-sectional area. For example, in Fig. 4, the circular cross-sectional area of O-ring 31 is greater than that of O-ring 17; and, the circular cross-sectional area of O-ring 32 is greater than that of O-ring 31.

A further method of providing O-rings of differing size is to have O-rings that have different shaped cross-sectional areas. For example, the cross-sectional area of one O-ring can be circular, while the cross-sectional area of another O-ring can be oval, square, etc.

Still another method of providing O-rings of differing size is to have O-rings that are not continuous circular members like O-ring 17 in Fig. 2, but that have one or more sections of the O-ring removed to produce a C-shaped O-ring or to produce an O-ring comprised of two or more separate pieces or segments.

Neck 12 and riser 11 are preferably, but not necessarily, cylindrically shaped. If, for example, hollow neck 12 and hollow riser 11 each have a square shape, the O-ring 17, or segments thereof, must be shaped and dimensioned to be mounted on the outer surface of the square neck 12.

As is illustrated in Fig. 5, the groove 21 that receives an O-ring 17 can be shaped to permit the O-ring 17 to roll along the bottom of groove 21 in the manner indicated by arrow G when O-ring 17 is displaced in the direction of arrow F when neck 12 is being inserted in riser 11 in the direction of arrow E such that an outer portion of O-ring 17 frictionally engages a portion of inner surface 26 to generate a tangential force on O-ring 17 that functions to displace O-ring 17 in the direction of arrow F. Fig. 6 illustrates the O-ring 17 and neck 12 of Fig. 5 after O-ring 17 has rolled in the direction of arrow F from the lower side 40 of groove 21 to the upper side 41 of groove 21.

The O-ring 17 or other elastomer can be fixedly attached to the outer surface of neck 12. It is presently preferred, however, that O-ring 17 be removably inserted in a groove 20 to facilitate replacing a worn O-ring 17 with a new O-ring and to facilitate replacing an O-ring 17 with an O-ring having a different size than O-ring 17.

It is important that O-ring 17 or other elastomer be resiliently compressible. Fig. 7 illustrates O-ring 17 in groove 21. Fig. 8 illustrates O-ring 17 in groove 21 after cylindrical neck 12 has been inserted in a first cylindrical riser 11 and

O-ring 17 has been resiliently compressed by wall 26 from a circular cross-sectional shape to an elliptical cross-sectional shape. Fig. 9 illustrates O-ring 17 in groove 21 after cylindrical neck 12 has been inserted in second cylindrical riser 11 and O-ring 17 has been compressed by wall 26 from a circular cross-sectional shape to an elliptical cross-sectional shape. The diameter of wall 26 in the second cylindrical riser is less than the diameter of wall 26 in the first cylindrical riser.

The shape and dimension of groove 21 can vary as desired. In one embodiment of the invention, groove 21 has a semi-circular shape, conforms to the lower portion of an O-ring 17, and prevents the O-ring 17 from rolling along the groove in the manner illustrated in Figs. 5 and 6. In another embodiment of the invention, groove 21 has a rectangular shape, similar to that illustrated in Figs. 5 and 6, but is sized to engage securely O-ring 17 and to prevent O-ring 17 from rolling along and over the groove bottom in the manner illustrated in Figs. 5 and 6. In a further embodiment of the invention, previously discussed, the groove 21 permits O-ring 17 to roll along the bottom of the groove 21 in the manner illustrated in Figs. 5 and 6. Regardless of the shape and dimension of groove 21, it is preferred, but not necessary, that O-ring 17 be able to rotate in, roll over, or otherwise move in the groove 21 to some extent because such movement permits new wear surfaces on O-ring 17 to be exposed to surface 26.

Having set forth my invention in terms to enable those skilled in the art to understand and practice the invention and having set forth the presently preferred

embodiments and uses thereof, I Claim: